ZDHC

ZDHC Wastewater Guidelines

Version 2.0

July 2022

NOTES

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a. Compliance with, or take the place of, legal or regulatory requirements. Examples might include[1]: stricter legal, local or regional wastewater and sludge limits; or other requirements relating to the handling and disposal of sludges shall supersede any requirements as set forth in the ZDHC Wastewater Guidelines.
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c. Nor do the ZDHC Wastewater Guidelines replace any national or international environmental or workplace safety requirements including, but not limited to regulations and/or standards.

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[1] For the avoidance of doubt this Disclaimer applies to all related documents produced by ZDHC, specifically: ZDHC Wastewater Guidelines, ZDHC Sludge Reference Document, ZDHC Wastewater and Sludge Laboratory Sampling and Analysis Plan and ZDHC Wastewater Industry Implementation Approach etc.

Introduction

The purpose of the ZDHC Wastewater Guidelines (hereafter referred to as “WW Guidelines”) is to set a single globally unified expectation for sampling, testing and reporting of industrial wastewater and sludge resulting from wet-processing, across the textile and leather industry. Separate wastewater guidelines are available for Man-Made Cellulosic Fibres (MMCF).

Industrial wastewater is generated at the wet processing stage, where textiles and leather are treated with auxiliaries and/or colourants using water as a carrier that contacts the manufactured material. To minimise the negative impact on the environment and human health, wastewater must be remediated before it is discharged to the environment the solid or semi-solid material separated during the wastewater treatment process, otherwise known as sludge, must be tested and disposed of in accordance with the latest version of ZDHC Sludge reference document.

The WW Guidelines set out limits for wastewater in terms of ‘conventional’ parameters (e.g. temperature, pH), heavy metals and chemicals listed on the ZDHC Manufacturing Restricted Substances List (ZDHC MRSL). Chemicals, such as heavy metals, can accumulate in sludge, and the limits for sludge are accompanied by recommended Disposal Pathways dependent on the type and level of chemical contamination. It is expected that brands, suppliers, and other stakeholders adopt and implement the wastewater and sludge limits. Suppliers should conduct tests, check results and, where appropriate, make adjustments to chemical inputs or effluent treatment processing and dispose of the sludge via the recommended pathway.

The WW Guidelines provide requirements for different effluent treatment models and clarify the type of suppliers that are in scope. It also provides details of sampling, testing and reporting requirements and directs the reader to more detailed supporting documents where appropriate. The WW Guidelines have been drawn up in collaboration with multiple industry specialists. They are intended for technical teams at industrial facilities, brands, laboratories and any other stakeholders involved in the continuous improvement of chemical inputs, wet processes and environmental discharges.

The benefits of adopting and implementing the WW Guidelines are:

- Running a unified sampling and testing programme
  - » Working on a set of unified expectation across the textile and footwear industries for wastewater discharge quality, which goes beyond regulatory conformance
  - » Collaborative working on processes and results accepted by key industry experts and stakeholders.
  - » Enabling a consistent approach to corrective action in case of event of an adverse finding.

- Elimination of duplicative testing
  - » The ability to share verified data via a secure ZDHC platform between suppliers and their brands reduces the request for multiple testing.

Contents

Revision History

In the spirit of continuous improvement, the WW Guidelines will be reviewed and revised as needed. These WW Guidelines were edited to incorporate learnings and opportunities identified during practical application and implementation in the past. This version covers major changes listed in Figure 1 below. For more details on the creation and history of these WW Guidelines refer to Appendix A.

Figure 1: Revision history of the ZDHC Wastewater Guidelines

Version Number	Changes	Time of Publication
Version 2.0	• We updated E.coli Table 3 and missing Anions in Table 4B and corrected lab method in Table 4A and 4B in the ZDHC Wastewater Guideline V2.0.	July 2022
Version 2.0	• We updated all the tables with correct methods and revised some text in the ZDHC Wastewater Guideline V2.0.	April 2022
Version 2.0	• Simplified the testing requirements for Direct, Indirect and Zero Liquid Discharge Suppliers. • Incorporation of the ZDHC MRSL V2.0 with wastewater limits and testing methods. • Review of the conventional parameters and addition of: E.coli, TDS, Sulfate. • Introduction on sludge ZDHC Disposal Pathways and new way of testing for sludge parameters. • Introduction of the wastewater candidate list. • Definitions have been moved to the Glossary.	March 2022
Previous Versions	See Appendix A: Expanded Revision History for more details	

Definitions of Terms

Visit the ZDHC Glossary to search for explanations on terminology used across this document and the ZDHC Foundation.

Related Work

This document is part of a set of guidelines and solutions provided by ZDHC. All stakeholders (suppliers, manufacturing facilities, brands and retailers, and laboratories) are expected to follow the most current guidance documents and practical tools given below:

- ZDHC Sludge Reference Document
- ZDHC Wasterwater and Sludge Laboratory Sampling and Analysis Plan
- ZDHC Wastewater Industry Implementation Approach
- ZDHC Wastewater Treatment System Operator Minimum Qualifications Guidelines
- ZDHC List of Accepted Laboratories for ZDHC Wastewater Guidelines Testing
- ZDHC Gateway
- ZDHC Academy for Wastewater Training and ETP Operator Qualification
- ZDHC Root Cause Analysis and Corrective Action Plan Template
- Supplier Platform for Effluent Treatment Module and for Support on Root Cause Analysis and Corrective Action Plan (Guidance and Template
- Supplier to Zero Programme as the ZDHC Supplier Performance Improvement Programme
- ZDHC Knowledge Base for Frequently asked Questions and Detailed User Guidance
- DETOX.Live Impact Map

ZDHC Wastewater Test Parameters

ZDHC MRSL Wastewater Parameters and Reporting Limits, Table 1A-1T

The chemical substances listed in the ZDHC MRSL, are restricted from intentional use in the textile and leather industry. The ZDHC MRSL wastewater parameters exclude the ZDHC MRSL Heavy Metals and ZDHC MRSL Candidate List; these are listed in their own tables. The purpose of ZDHC MRSL wastewater parameters testing is to check for intentional use of ZDHC MRSL chemical substances and/or high levels of respective contamination in the chemical inputs. Hence, the ZDHC WW Guidelines requires sampling of ZDHC MRSL wastewater parameters in the ***untreated*** wastewater only. This also allows us to compare ZDHC MRSL data for all supplier types: Direct, Indirect, and Zero Liquid Discharge.

Reporting limits mentioned in the following tables apply to every single chemical substance of the respective substance group. The methods for analysis/testing recommended in these WW Guidelines are based on recommendations from the ZDHC Laboratory Advisory Group.

In the case of 'technical textiles' e.g. textiles for first responders, medical use, transport and military personnel, there may be legally or contractually mandated performance standards that can only be met by using chemicals that are listed on the ZDHC MRSL, hence detections may be found in the wastewater as a result of their deliberate use. Whilst the use of some listed chemicals is sometimes required, suppliers must take measures to prevent them from entering waste streams and discharged effluent.

Table 1A: **Alkylphenol (AP) and Alkylphenol Ethoxylates (APEOs): including all isomers**

Substance	CAS Number	Reporting Limit (µg/L)	Standard Method for Analysis/Testing
Nonylphenol ethoxylates (NPEO)	9016-45-9 26027-38-3 37205-87-1 68412-54-4 127087-87-0		NP/OP: ISO 18857-2 (modified dichloromethane extraction) or ASTM D7065 (GC-MS or LC-MS(-MS) OPEO/NPEO (n>2): ASTM D7742 ISO 18857-2
Nonylphenol (NP), mixed isomers	104-40-5 11066-49-2 25154-52-3 84852-15-3	Textile and Leather: 5	NP/OP: ISO 18857-2 (modified dichloromethane extraction) or ASTM D7065 (GC-MS or LC-MS(-MS) OPEO/NPEO (n>2): ASTM D7742 ISO 18857-2
Octylphenol ethoxylates (OPEO)	9002-93-1 9036-19-5 68987-90-6		NP/OP: ISO 18857-2 (modified dichloromethane extraction) or ASTM D7065 (GC-MS or LC-MS(-MS) OPEO/NPEO (n>2): ASTM D7742 ISO 18857-2

Table 1A: **Alkylphenol (AP) and Alkylphenol Ethoxylates (APEOs): including all isomers (continued)**

Substance	CAS Number	Reporting Limit (µg/L)	Standard Method for Analysis/Testing
Octylphenol (OP), mixed isomers	140-66-9 1806-26-4 27193-28-8	Textile and Leather: 5	NP/OP: ISO 18857-2 (modified dichloromethane extraction) or ASTM D7065 (GC-MS or LC-MS(-MS) OPEO/NPEO (n>2): ASTM D7742 ISO 18857-2

Table 1B: **Anti- Microbials & Biocides**

Substance	CAS Number	Reporting Limit (µg/L)	Standard Method for Analysis/Testing
o-Phenylphenol (+salts)	90-43-7	Textile only: 100	USEPA 8270E Solvent extraction, derivatisation with KOH, acetic anhydride followed by GC-MS BS EN 12673-1999 an alternative method of solvent extraction and derivatization are included
Triclosan	3380-34-5	Textile only: 100	
Permethrin	Multiple	Textile only: 500	USEPA 8270E Solvent extraction, followed by GC-MS ISO 14154:2005 An alternate method, without derivatization and determination by LCMS/LCMSMS is also possible

Table 1C: **Chlorinated Parafins**

Substance	CAS Number	Reporting Limit (µg/L)	Standard Method for Analysis/Testing
Medium-chain Chlorinated paraffins (MCCPs) (C14-C17)	85535-85-9	Textile only: 5	Preparation: EPA 3510 Analysis: ISO18219-2:2021 Method for MCCP with GC-MS(NCI) or LC-MS/MS
Short-chain Chlorinated paraffin (C10 – C13)	85535-84-8		Preparation EPA 3510 Analysis: ISO18219-1:2021, ISO 12010:2019 Methods for SCCP with GC-MS(NCI) or LC-MS/MS

Table 1D: **Chlorobenzenes and Chlorotoluenes**

Substance	CAS Number	Reporting Limit (µg/L)	Standard Method for Analysis/Testing
1,2-dichlorobenzene	95-50-1	Textile and Leather: 0.2	USEPA 8260D, 8270E, Purge and Trap, Head Space Dichloromethane extraction followed by GC-MS
Other isomers of mono-, di-, tri-, tetra-, penta- and hexa- Chlorobenzene and mono-, di-, tri-, tetra- and penta- chlorotoluene	Multiple		

Table 1E: **Chlorophenols**

Substance	CAS Number	Reporting Limit (µg/L)	Standard Method for Analysis/Testing
2-chlorophenol	95-57-8	Textile and Leather: 0.5	USEPA 8270E Solvent extraction, derivatisation with KOH, acetic anhydride followed by GC-MS BS EN 12673-1999 the procedure of solvent extraction and derivatization are included
3-chlorophenol	108-43-0		
4-chlorophenol	106-48-9		
2,3-dichlorophenol	576-24-9		
2,4-dichlorophenol	120-83-2		
2,5-dichlorophenol	583-78-8		
2,6-dichlorophenol	87-65-0		
3,4-dichlorophenol	95-77-2		
3,5-dichlorophenol	591-35-5		
2,3,4-trichlorophenol	15950-66-0		
2,3,5-trichlorophenol	933-78-8		
2,3,6-trichlorophenol	933-75-5		
2,4,5-trichlorophenol	95-95-4		
2,4,6-trichlorophenol	88-06-2		
3,4,5-trichlorophenol	609-19-8		
2,3,5,6-tetrachlorophenol	935-95-5		
2,3,4,6-tetrachlorophenol	58-90-2		
2,3,4,5-tetrachlorophenol	4901-51-3		
Pentachlorophenol (PCP)	87-86-5		

Table 1F: **N,N-di-methylformamide (DMFa)**

Substance	CAS Number	Reporting Limit (µg/L)	Standard Method for Analysis/Testing
Dimethyl formamide; N,N-dimethylformamide (DMFa)[a]	68-12-2	Textile only: 1000	EPA 8015, EPA 8270E

Table 1G: **Dyes – Carcinogenic or Equivalent Concern**

Substance	CAS Number	Reporting Limit (µg/L)	Standard Method for Analysis/Testing
Basic violet 3 with >0.1% of Michler´s Ketone[b]	548-62-9	Textile and Leather: 500	Liquid extraction, LC-MS
C.I. Acid Red 26	3761-53-3		
C.I. Acid Violet 49	1694-09-3		
C.I. Basic Blue 26 (with Michler's Ketone > 0.1%)	2580-56-5		
C.I. Basic Green 4 (Malachite Green Chloride)	569-64-2		
C.I. Basic Green 4 (Malachite Green Oxalate)	2437-29-8		
C.I. Basic Green 4 (Malachite Green)	10309-95-2		
C.I. Basic Red 9	569-61-9		
C.I. Basic Violet 14	632-99-5		
C.I. Direct Black 38	1937-37-7		
C.I. Direct Blue 6	2602-46-2		
C.I. Direct Red 28	573-58-0		

[a] Sample and Report only for mock leather.

[b] Reported concentration refers to the dye part only.

Table 1G: **Dyes – Carcinogenic or Equivalent Concern (continued)**

Substance	CAS Number	Reporting Limit (µg/L)	Standard Method for Analysis/Testing
C.I. Disperse Blue 1	2475-45-8	Textile only: 500	Liquid extraction, LC-MS
C.I. Disperse Blue 3	2475-46-9		
Disperse Orange 11	82-28-0		

Table 1H: **Dyes – Disperse (Allergenic)**

Substance	CAS Number	Reporting Limit (µg/L)	Standard Method for Analysis/Testing
Disperse Blue 102	12222-97-8	Textile only: 50	Liquid extraction, LC-MS
Disperse Blue 106	12223-01-7		
Disperse Blue 124	61951-51-7		
Disperse Blue 26	3860-63-7		
Disperse Blue 35	12222-75-2		
Disperse Blue 35	56524-77-7		
Disperse Blue 7	3179-90-6		
Disperse Brown 1	23355-64-8		
Disperse Orange 1	2581-69-3		
Disperse Orange 3	730-40-5		
Disperse Orange 37/59/76	13301-61-6		
Disperse Red 1	2872-52-8		
Disperse Red 11	2872-48-2		
Disperse Red 17	3179-89-3		
Disperse Yellow 1	119-15-3		
Disperse Yellow 3	2832-40-8		

Table 1H Substance Group: **Dyes – Disperse (Allergenic) (continued)**

Substance	CAS Number	Reporting Limit (µg/L)	Standard Method for Analysis/Testing
Disperse Yellow 39	12236-29-2	Textile only: 50	Liquid extraction, LC-MS
Disperse Yellow 49	54824-37-2		
Disperse Yellow 9	6373-73-5		

Table 1I: **Dyes – Navy Blue Colourant**

Substance	CAS Number	Reporting Limit (µg/L)	Standard Method for Analysis/Testing (parameter has been moved to the archive list)
Component 1: C39H23Cl-CrN7O12S 2Na	118685-33-9	Textile and Leather: 500	Liquid extraction, LC-MS
Component 2: C46H-30CrN10O20S2 3Na	Not Allocated		

Table 1J: **Flame Retardants**

Substance	CAS Number	Reporting Limit (µg/L)	Standard Method for Analysis/Testing
2,2-bis(bromomethyl)-1,3-propanediol (BBMP)	3296-90-0	Textile: 25 Leather: 5	USEPA 8270E, ISO 22032, USEPA 527 and USEPA 8321B Dichloromethane extraction GC-MS or LC-MS(-MS)
Bis(2,3-dibromopropyl) phosphate (BIS)	5412-25-9		
Decabromodiphenyl ether (DecaBDE)	1163-19-5		
Hexabromocyclodecane (HBCDD)	3194-55-6		

Table 1J: **Flame Retardants (continued)**

Substance	CAS Number	Reporting Limit (µg/L)	Standard Method for Analysis/Testing
Octabromodiphenyl ether (OctaBDE)	32536-52-0	Textile: 25 Leather: 5	USEPA 8270, ISO 22032, USEPA 527 and USEPA 8321B Dichloromethane extraction GC-MS or LC-MS(-MS)
Pentabromodiphenyl ether (PentaBDE)	32534-81-9		
Polybromobiphenyls (PBB)	59536-65-1		
Tetrabromobisphenol A (TBBPA)	79-94-7		
Tris-(2-chloro-1-methylethyl) phosphate (TCPP)	13674-84-5		
Tris(1-aziridinyl)phosphine oxide) (TEPA)	545-55-1		
Tris(1,3-dichloro-isopropyl) phosphate (TDCP)	13674-87-8		
Tris(2-chloroethyl) phosphate (TCEP)	115-96-8		
Tris(2,3,-dibromopropyl)- phosphate (TRIS)	126-72-7		
Decabromobiphenyl (DecaBB)	13654-09-6	Textile only: 25	
Dibromobiphenyls (DiBB)	Multiple		
Octabromobiphenyls (OctaBB)			
Dibromopropylether	21850-44-2		
Heptabromodiphenyl ether (HeptaBDE)	68928-80-3		
Hexabromodiphenyl ether (HexaBDE)	36483-60-0		
Monobromobiphenyls (MonoBB)	Multiple		
Monobromodiphenylethers (MonoBDEs)			
Nonabromobiphenyls (NonaBB)			

Table 1J: **Flame Retardants (continued)**

Substance	CAS Number	Reporting Limit (µg/L)	Standard Method for Analysis/Testing
Nonabromodiphenyl ether (NonaBDE)	63936-56-1	Textile only: 25	USEPA 8270E, ISO 22032, USEPA 527 and USEPA 8321B Dichloromethane extraction GC-MS or LC-MS(-MS)
Tetrabromodiphenyl ether (TetraBDE)	40088-47-9		
Tribromodiphenylethers (TriBDEs)	Multiple		
Boric acid	10043-35-3 11113-50-1	Textile only: 100[c]	determined as total boron via ICP
Diboron trioxide	1303-86-2		
Disodium octaborate	12008-41-2		
Disodium tetraborate anhydrous	1303-96-4 1330-43-4		
Tetraboron disodium heptaoxide, hydrate	12267-73-1		

Table 1K: **Glycols / Glycol Ethers**

Substance	CAS Number	Reporting Limit (µg/L)	Standard Method for Analysis/Testing
2-ethoxyethanol	110-80-5	Textile and Leather: 50	USEPA 8270E Liquid extraction, LC-MS GC-MS
2-ethoxyethyl acetate	111-15-9		
2-methoxyethanol	109-86-4		
2-methoxyethylacetate	110-49-6		
2-methoxypropylacetate	70657-70-4		
Bis(2-methoxyethyl)-ether	111-96-6		

[c] Limit refers to elemental boron, not the salt.

Table 1K: **Glycols / Glycol Ethers (continued)**

Substance	CAS Number	Reporting Limit (µg/L)	Standard Method for Analysis/Testing
Ethylene glycol dimethyl ether	110-71-4	Textile and Leather: 50	USEPA 8270E Liquid extraction, LC-MS GC-MS
Triethylene glycol dimethyl ether	112-49-2		

Table 1L: **Halogenated Solvents**

Substance	CAS Number	Reporting Limit (µg/L)	Standard Method for Analysis/Testing
1,2-dichloroethane	107-06-2	Textile and Leather: 1	USEPA 8260D Headspace GC-MS or Purge and trap GC-MS
Methylene chloride	75-09-2		
Tetrachloroethylene	127-18-4		
Trichloroethylene	79-01-6		

Table 1M: **Organotin Compounds**

Substance	CAS Number	Reporting Limit (µg/L)	Standard Method for Analysis/Testing
Dipropyltin compounds (DPT)	Multiple	Textile and Leather: 0.01	ISO 17353 Derivatisation with NaB (C2H5)4 GC-MS
Mono-, di- and tri-butyltin derivatives			
Mono-, di- and tri-methyltin derivatives			
Mono-, di- and tri-octyltin derivatives			
Mono-, di- and tri-phenyltin derivatives			
Tetrabutyltin compounds (TeBT)			
Tripropyltin Compounds (TPT)			
Tetraoctyltin compounds (TeOT)			
Tricyclohexyltin (TCyHT)			
Tetraethyltin Compounds (TeET)			ISO 17353

Table 1N: **Other/Miscellaneous Chemicals**

Substance	CAS Number	Reporting Limit (µg/L)	Standard Method for Analysis/Testing
AEEA [2-(2-aminoethylamino)ethanol]	111-41-1	Textile only: 500	Liquid extraction, LC-MSMS
Bisphenol A	80-05-7	Textile only: 10	Liquid extraction, LC-MS
Thiourea	62-56-6	Textile only: 50	
Quinoline	91-22-5		
Borate, zinc salt	12767-90-7	Textile only: 100[d]	determined as total boron and total zinc via ICP
Silica[e] (Used in sand blasting)	14464-46-1	Textile and Leather: N/A	Not a ZDHC Wastwater parameter

Table 1O: **Perfluorinated and Polyfluorinated Chemicals (PFCs)**

Substance	CAS Number	Reporting Limit (µg/L)	Standard Method for Analysis/Testing
Perfluorooctane sulfonate (PFOS) and related substances	Multiple	Textile and Leather: 0.01	PFCs: EPA 537:2020 FTOH: BS EN 12673-1999, EPA 8270, PFCs: LC-MSMS FTOH: GC-MS Derivatisation with acetic anhydride followed by GC-MS
Perfluorooctanoic acid (PFOA) and related substances		Textile and Leather: 1	

[d] Limit refers to boron and zinc individually, not the salt.
[e] Not required to test this parameter as this is related to sand blasting

Table 1P: **Phthalates – including all other esters of ortho-phthalic acid**

Substance	CAS Number	Reporting Limit (µg/L)	Standard Method for Analysis/Testing
1,2-benzenedicarboxylic acid, di-C6-8 branched and liearalkyl esters , C7-rich (DIHP)	71888-89-6 84777-06-0	Textile and Leather: 10	USEPA 8270E, ISO 18856 Dichloromethane extraction GC-MS
1,2-benzenedicarboxylic acid, di-C7-11 branched and liearalkyl esters (DHNUP)	68515-42-4 68515-50-4		
Bis(2-methoxyethyl) phthalate (DMEP)	117-82-8		
Butyl benzyl phthalate (BBP)	85-68-7		
Di-cyclohexyl phthalate (DCHP)	84-61-7		
Di-iso-decyl phthalate (DIDP)	26761-40-0		
Di-iso-octyl phthalate (DIOP)	27554-26-3		
Di-isobutyl phthalate (DIBP)	84-69-5		
Di-isononyl phthalate (DINP)	28553-12-0		
Di-n-hexyl phthalate (DnHP)	84-75-3		
Di-n-octyl phthalate (DNOP)	117-84-0		
Di-n-pentylphthalates	131-18-0		
Di-n-propyl phthalate (DPRP)	131-16-8		
Di(ethylhexyl) phthalate (DEHP)	117-81-7		
Dibutyl phthalate (DBP)	84-74-2		

Table 1P: **Phthalates – including all other esters of ortho-phthalic acid (continued)**

Substance	CAS Number	Reporting Limit (µg/L)	Standard Method for Analysis/Testing
Diethyl phthalate (DEP)	84-66-2	Textile and Leather: 10	USEPA 8270E, ISO 18856 Dichloromethane extraction GC-MS
Diisopentylphthalates	605-50-5		
Dinonyl phthalate (DNP)	84-76-4		

Table 1Q: **Polycyclic Aromatic Hydrocarbons (PAHs)**

Substance	CAS Number	Reporting Limit (µg/L)	Standard Method for Analysis/Testing
Acenaphthene	83-32-9	Textile and Leather: 1	USEPA 8270E DIN 38407-39 Solvent extraction GC-MS
Acenaphthylene	208-96-8		
Anthracene	120-12-7		
Benzo[a]anthracene	56-55-3		
Benzo[a]pyrene (BaP)	50-32-8		
Benzo[b]fluoranthene	205-99-2		
Benzo[e]pyrene	192-97-2		
Benzo[ghi]perylene	191-24-2		
Benzo[j]fluoranthene	205-82-3		
Benzo[k]fluoranthene	207-08-9		
Chrysene	218-01-9		
Dibenz[a,h]anthracene	53-70-3		

Table 1Q: **Polycyclic Aromatic Hydrocarbons (PAHs) (continued)**

Substance	CAS Number	Reporting Limit (µg/L)	Standard Method for Analysis/Testing
Fluoranthene	206-44-0	Textile and Leather: 1	USEPA 8270E DIN 38407-39 Solvent extraction GC-MS
Fluorene	86-73-7		
Indeno[1,2,3-cd]pyrene	193-39-5		
Naphthalene	91-20-3		
Phenanthrene	85-01-8		
Pyrene	129-00-0		

Table 1R: **Restricted Aromatic Amines (Cleavable from Azo-colourants)[f]**

Substance	CAS Number	Reporting Limit (µg/L)	Standard Method for Analysis/Testing
2-naphthylamine	91-59-8	Textile and Leather: 0.1	Reduction step with sodium dithionite, solvent extraction EPA 8270
2-Naphthylammoniumacetate	553-00-4		
2,4-xylidine	95-68-1		
2,4,5-trimethylaniline	137-17-7		
2,4,5-trimethylaniline hydrochloride	21436-97-5		
2,6-xylidine	87-62-7		
3,3'-dichlorobenzidine	91-94-1		
3,3-dimethoxylbenzidine	119-90-4		
3,3-dimethylbenzidine	119-93-7		

[f] Previously referred to as 'Dyes – Azo (Forming Restricted Amines).'

Table 1R: **Restricted Aromatic Amines (Cleavable from Azo-colourants)[f] (continued)**

Substance	CAS Number	Reporting Limit (µg/L)	Standard Method for Analysis/Testing
4-aminoazobenzene	60-09-3	Textile and Leather: 0.1	Reduction step with sodium dithionite, solvent extraction EPA 8270
4-aminodiphenyl	92-67-1		
4-chloro-o-toluidine	95-69-2		
4-chloro-o-toluidinium chloride	3165-93-3		
4-chloroaniline	106-47-8		
4-methoxy-m-phenylene diammonium sulphate; 2,4-diaminoanisole sulphate	39156-41-7		
4-methoxy-m-phenylenediamine	615-05-4		
4-methyl-m-phenylenediamine	95-80-7		
4,4-methylene-bis-(2-chloro-aniline)	101-14-4		
4,4-methylenedi-o-toluidine	838-88-0		
4,4-methylenedianiline	101-77-9		
4,4-oxydianiline	101-80-4		
4,4-thiodianiline	139-65-1		
5-nitro-o-toluidine	99-55-8		
6-methoxy-m-toluidine	120-71-8		
Benzidine	92-87-5		
o-aminoazotoluene	97-56-3		
o-anisidine	90-04-0		
o-toluidine	95-53-4		

[f] Previously referred to as 'Dyes – Azo (Forming Restricted Amines).'

Table 1S: **UV Absorbers**

Substance	CAS Number	Reporting Limit (µg/L)	Standard Method for Analysis/Testing
2-(2H-benzotriazol-2-yl)-4-(tert-butyl)-6-(sec- butyl) phenol (UV-350)	36437-37-3	Textile only: 100	USEPA 8270 ISO 22032, USEPA 527 and USEPA 8321B. Dichloromethane extraction GC-MS or LC-MS(-MS)
2-(2H-benzotriazol-2-yl)-4,6-ditertpentylphenol (UV-328)	25973-55-1		
2-benzotriazol-2-yl-4,6-di-tert-butylphenol (UV-320)	3846-71-7		
2,4-Di-tert-butyl-6-(5-chlorobenzotriazole-2-yl) phenol (UV-327)	3864-99-1		

Table 1T: **Volatile Organic Compounds (VOC)**

Substance	CAS Number	Reporting Limit (µg/L)	Standard Method for Analysis/Testing
Benzene	71-43-2	Textile and Leather: 1	ISO 11423-1 Headspace or Purge and trap GC-MS USEPA 8260D Add ISO 20595 Static headspace for determination of VOC in wastewater
m-cresol	108-39-4		ISO 11423-1 Headspace or Purge and trap GC-MS EPA 8270 BS EN 12673-1999

Table 1T: **Volatile Organic Compounds (VOC) (continued)**

Substance	CAS Number	Reporting Limit (µg/L)	Standard Method for Analysis/Testing
o-cresol	95-48-7	Textile and Leather: 1	ISO 11423-1 Headspace or Purge and trap GC-MS EPA 8270 BS EN 12673-1999
p-cresol	106-44-5		
Xylene	1330-20-7	Textile only: 1	ISO 11423-1 Headspace or Purge and trap GC-MS USEPA 8260D
Toluene[g]	108-88-3	Textile only: 1	HJ 1067 or EPA 8260D or ISO 11423-1

[g] Sample and Report only for mock leather.

For note taking:

ZDHC Heavy Metals Wastewater Parameters and Limits, Table 2

Heavy metals can be present in incoming water, in raw materials such as polyester and metal complex dyes, as well as in the piping of the water distribution systems.

Unlike other ZDHC MRSL parameters, heavy metals are often included in legally mandated standards and are therefore listed separately in these guidelines.

ZDHC has created a three-level approach to the limits for heavy metals (and Conventional parameters – in Table 3) to promote continuous improvement. The limits get more stringent as they move from Foundational, Progressive to Aspirational levels.

We encourage suppliers to strive for continuous improvement on their impact on the environment and human health. This can be achieved by proactively developing and managing data driven, continuous improvement plans addressing input chemistry, chemical management systems and output control.

These guidelines recommend methods for analysis and testing based on internationally recognised standard water and wastewater testing methodologies, as well as government-recognised testing requirements in the European Union, the United States of America, China, and India. Equivalent methods can be used only if approved by ZDHC.

Parameter	**Unit**	**Parameter limit values**			**Standard methods for analysis and testing** Equivalent methods can be used if approved by ZDHC			
		Wastewater Foundational	Wastewater Progressive	Wastewater Aspirational	International/ Europe	USA	China	India
Antimony[a]	mg/L	Textile and Leather: 0.1	Textile and Leather: 0.05	Textile and Leather: 0.01	ISO 17294	USEPA 200.8 USEPA 6010C USEPA 6020A	HJ 700	IS 3025 (Part 65)
Chromium (VI)	mg/L	Textile: 0.05 Leather: 0.15	Textile: 0.005 Leather: 0.05	Textile: 0.001 Leather: 0.02	ISO 18412	USEPA 218.6	GB 7467	IS 3025 (Part 52) must meet reporting limit
Barium	mg/L	Textile: Sample and report only				EPA 200.8 EPA 6010C EPA 6020A	HJ 700	
Selenium	mg/L							
Tin	mg/L							

[a] For polyester wet processing facilities Foundational, Progressive and Aspirational limits do not yet apply (unless required by law or voluntarily adopted), however facilities must continue to sample and report on the Antimony parameter. ZDHC intends to introduce these limits for Polyester wet processing facilities by 2025 which can be met by adopting antimony-free polyester and/or mitigation technologies.

Table 2:
Heavy Metals
(continued)

Parameter	Unit	Parameter limit values			Standard methods for analysis and testing Equivalent methods can be used if approved by ZDHC			
		Wastewater Foundational	Wastewater Progressive	Wastewater Aspirational	International/ Europe	USA	China	India
Arsenic	mg/L	Textile and Leather: 0.05	Textile and Leather: 0.01	Textile and Leather: 0.005	ISO 17294	USEPA 200.8 USEPA 6010C USEPA 6020A	HJ 700	IS 3025 (Part 65)
Chromium, total	mg/L	Textile: 0.2 Leather: 1.5	Textile: 0.1 Leather: 0.8	Textile: 0.05 Leather: 0.3				IS 3025 (Part 65)
Cobalt	mg/L	Textile and Leather: 0.05	Textile and Leather: 0.02	Textile and Leather: 0.01				
Cadmium	mg/L	Textile and Leather: 0.1	Textile and Leather: 0.05	Textile and Leather: 0.01				IS 3025 (Part 65) IS 3025 (Part 41) AAS Instrumental Method
Copper	mg/L	Textile and Leather: 1	Textile and Leather: 0.5	Textile and Leather: 0.25			GB 7475 HJ 700	IS 3025 (Part 65) IS 3025 (Part 42) AAS Instrumental Method
Lead	mg/L	Textile and Leather: 0.1	Textile and Leather: 0.05	Textile and Leather: 0.01				IS 3025 (Part 65) IS 3025 (Part 47) AAS Instrumental Method
Nickel	mg/L	Textile and Leather: 0.2	Textile and Leather: 0.1	Textile and Leather: 0.05			GB 11912 HJ 700	IS 3025 (Part 65) IS 3025 (Part 54) AAS Instrumental Method
Silver	mg/L	Textile and Leather: 0.1	Textile and Leather: 0.05	Textile and Leather: 0.005			GB 11907 HJ 700 I	IS 3025 (Part 65)
Zinc	mg/L	Textile and Leather: 5	Textile and Leather: 1	Textile and Leather: 0.5			GB 7472 GB 7475 HJ 700	IS 3025 (Part 65) IS 3025 (Part 49) AAS Instrumental Method
Mercury	mg/L	Textile and Leather: 0.01	Textile and Leather: 0.005	Textile and Leather: 0.001	ISO 17294	EPA 200.8-SIM EPA 6020A-SIM EPA 245.1 EPA 245.7	HJ 597 HJ 694	IS 3025 part 48 cold vapor AAS only, IS 3025 part 65-SI

ZDHC Conventional Parameters and Anions for Wastewater, Table 3

Conventional parameters such as pH, temperature, and biological oxygen demand, have traditionally been used to describe and regulate wastewater quality.

ZDHC has created a three-level approach to the limits for heavy metals (and Conventional parameters – in Table 3) to promote continuous improvement. The limits get more stringent as they move from Foundational, Progressive to Aspirational levels. We encourage vsuppliers to strive for continuous improvement on their impact on the environment and human health.

This can be achieved by proactively developing and managing data driven, continuous improvement plans addressing input chemistry, chemicals management systems and output control.

These guidelines recommend methods for analysis and testing based on internationally recognised standard water and wastewater testing methodologies, as well as government-recognised testing requirements in the European Union, the United States of America, China, and India. Equivalent methods can be used if approved by ZDHC.

Parameter	**Unit**	**Parameter limit values**			**Standard methods for analysis and testing** Equivalent methods can be used if approved by ZDHC			
		Wastewater Foundational	Wastewater Progressive	Wastewater Aspirational	International/ Europe	USA	China	India
Conventional Parameters (Testing conducted during sample collection for pH, Temperature difference, Persistent Foam, Wastewater flowrate, DO, Total Chlorine)								
pH[a]	pH	Textile and Leather: 6 - 9			ISO 10523	USEPA 150.1 SM 4500-H+	HJ 1147	IS 3025 (Part 11) Electrometric method only
Temperature difference[b]	°C	Textile and Leather:			DIN 38 404-4 or equivalent	USEPA 170.1 SM 2550	GB/T 13195	IS 3025 (Part 9)
		Δ+15	Δ+10	Δ+5				
E.coli	MPN/100-ml	Textile and Leather: 126 MPN/100-ml				SM 9221B presumtive, confirm positive with SM9221F or G		
Colour[c] (436nm; 525nm; 620nm)	m-1	Textile and Leather:			ISO 7887-B			
		7; 5; 3	5; 3; 2	2; 1; 1				
Persistent Foam[d]		Textile and Leather: No indication of Persistent foam in recieving water			N/A			
Wastewater Flowrate[a]	15m^3 per day							

[a] These tests are to be done on-site by the sampler.

[b] Take the temperature of the discharged wastewater and the receiving body of water upstream. Subtract the temperature of the receiving body from the temperature of the discharge to give the delta temperature difference, which can be a positive or a negative value. The discharge limits only refer to a positive value, which produces an overall increase in the temperature of the receiving body of water. This test is to be done on-site by the sampler and is applicable only for direct discharge.

[c] Colour must be tested and reported in accordance with standard method ISO 7887-B for ZDHC testing purposes. Local regulations may require an additional test method.

[d] Foam is a naturally occurring phenomenon in aeration basins in which biological wastewater treatment occurs. Samplers should include photographs of the foam they witnessed in the final lab report, along with the time and date of taking such photos. The foam colour should be similar to the liquid in the aeration basin, should dissipate quickly, and should be contained within the aeration basin. If the foam is higher than 45 centimetres (by visual estimation) then it could result in permanent foam being discharged onto the surface of receiving waters and should be noted. For direct discharge facilities samplers should check for persistent foam on the surface of receiving waters at the point of discharge and the presence or absence of foam should be noted. This should be checked at the same location used for sampling the temperature difference. This test is to be done on-site by the sampler and should be checked at the same location used for ΔT sample checks.

Table 3: Conventional Parameters and Anions for Wastewater (continued)

Parameter	Unit	Parameter limit values			Standard methods for analysis and testing Equivalent methods can be used if approved by ZDHC			
		Wastewater Foundational	Wastewater Progressive	Wastewater Aspirational	International/ Europe	USA	China	India
Conventional Parameters (Testing conducted during sample collection for pH, Temperature difference, Persistent Foam, Wastewater flowrate, DO, Total Chlorine)								
Ammonium-Nitrogen	mg/L	Textile: 10 Leather: 15	Textile: 1 Leather: 10	Textile: 0.5 Leather: 1	ISO 11732 ISO 7150	USEPA 350.1 USEPA 350.3 SM 4500 NH3 - D, E, F, G, or H	HJ 535	IS 3025 (Part 34) phenate or ammonia selective electrode only
AOX	mg/L	Textile only: 3	Textile only: 0.5	Textile only: 0.1	ISO 9562	HACH LCK 390	HJ/T 83-2001	
Biochemical Oxygen Demand 5-days concentration (BOD_5)	mg/L	Textile: 30 Leather: 50	Textile: 15 Leather: 30	Textile: 8 Leather: 20	ISO 5815-1	USEPA 405.1 SM 5210-B	HJ 505	IS 3035 (Part 44) seeded dilution water (BOD_5)
Chemical Oxygen Demand (COD)	mg/L	Textile: 150 Leather: 250	Textile: 80 Leather: 150	Textile: 40 Leather: 100	ISO 6060[e] ISO 15705	USEPA 410.4 SM 5220-D	HJ 828 GB/T 11914 e	IS 3025 (Part 58) e
Dissolved Oxygen (DO)[a]	mg/L	Textile and Leather: Sample and report only			ISO 5814	EPA 360.1 SM 4500-O-G	HJ 506	
Oil & Grease	mg/L	Textile: 10 Leather: 20	Textile: 2 Leather: 10	Textile: 0.5 Leather: 5	ISO 9377-2	SM 5520-B/C USEPA 1664 revision B	HJ 637 (total oil and grease)	IS 3025 (Part 39) partition gravimetric or partition Infra-red
Total Phenols / Phenol Index	mg/L	Textile and Leather: 0.5	Textile: 0.01 Leather: 0.3	Textile: 0.001 Leather: 0.1	ISO 6439	SM 5530-B/C	HJ 503 must meet required reporting limit	IS 3025 (Part 43)
Total Chlorine[a]	mg/L	Textile and Leather: Sample and report only			ISO 7393-2	EPA 330.5 SM4500-Cl-G	HJ 586	
Total Dissolved Solids (TDS)[f]	mg/L	Textile and Leather: Sample and report only				SM 2540-C USEPA 160.1	GB/T 5750.4-2006 180°C (180 degree centigrade)	IS 3025 (Part 16) 179°C to 181°C

[a] These tests are to be done on-site by the sampler.

[e] Validated cuvette methods can be used alternatively.

[f] Salt that is deliberately used in wet processing or that is formed as a result of neutralisation reactions, and that is not remediated by a standard ETP, can negatively affect the aquatic environment when discharged. To promote less deliberate use and formation of salt, it is intended to introduce a requirement for Total Dissolved Solids (TDS) to be measured and reported, prior to the introduction of a limit.

Table 3: Conventional Parameters and Anions for Wastewater (continued)

Parameter	Unit	Parameter limit values			Standard methods for analysis and testing Equivalent methods can be used if approved by ZDHC			
		Wastewater Foundational	Wastewater Progressive	Wastewater Aspirational	International/ Europe	USA	China	India
Conventional Parameters (Testing conducted during sample collection for pH, Temperature difference, Persistent Foam, Wastewater flowrate, DO, Total Chlorine)								
Total Nitrogen	mg/L	Textile: 20 Leather: 35	Textile: 10 Leather: 20	Textile: 5 Leather: 10	ISO 11905 - Part 1 ISO 29441	USEPA 351.2 SM 4500P-J SM 4500N-B SM 4500N-C	HJ 636	IS 3025 (Part 34) measure and total all forms of nitrogen (ammonia,nitrate, nitrite,organic)
Total Phosphorus	mg/L	Textile and Leather: 3	Textile: 0.5 Leather: 1	Textile: 0.1 Leather: 0.5	ISO 17294 ISO 11885 ISO 6878	USEPA 365.4 SM 4500P-J USEPA 200.7 USEPA 200.8 USEPA 6010C USEPA 6020A	GB/T 11893	IS 3025 (Part 31) IS 3025 (Part 65)
Total Suspended Solids (TSS)	mg/L	Textile: 50 Leather: 70	Textile: 15 Leather: 50	Textile: 5 Leather: 20	ISO 11923	USEPA 160.2 SM 2540D	GB/T 11901	IS 3025 (Part 17) 103°C to 105°C
Anions								
Chloride	mg/L	Textile and Leather: Sample and report only			ISO 10304-1 ISO 15923-1	SM 4110-B SM 4110-C SM 4500-Cl D or E USEPA 300	HJ 84-2016	IS 3025 (Part 32) potentiometric or automated ferricyanide only
Cyanide, total	mg/L	Textile only: 0.2	Textile only: 0.1	Textile only: 0.05	ISO 6703-1,-2,-3, ISO 14403-1,-2	USEPA 335.2, APHA 4500-CN	HJ 484	
Sulfate	mg/L	Textile and Leather: Sample and report only			ISO 10304-1 ISO 15923-1	SM 4500 SO4, E, F, G SM 4110 B, C USEPA 300 USEPA 9038	HJ 84-2016	IS 3025 (Part 24)
Sulfide	mg/L	Textile: 0.5 Leather: 1	Textile: 0.05 Leather: 0.5	Textile: 0.01 Leather: 0.2	ISO 10530	SM 4500-S2-D, E,G, or I	GB/T 16489	IS 3025 (Part 29) Methylene blue only
Sulfite	mg/L	Textile only: 2	Textile only: 0.5	Textile only: 0.2	ISO 10304-3	SM 4500-SO32-C	HJ 84-2016	

ZDHC Sludge Disposal Pathways, Parameters and Limits, Table 4A-4C

The ZDHC Sludge Reference Document further defines and explains the ZDHC Disposal Pathways and provides a methodology for suppliers to determine their pathway. If more than one Disposal Pathway is used by a facility, please choose the pathway that is used for the majority of the sludge generated.

The WW Guideline defines seven ZDHC Disposal Pathways, they are:

- ZDHC Disposal Pathway A - Offsite Incineration at >1000°C
- ZDHC Disposal Pathway B - Landfill with Significant Control Measures
- ZDHC Disposal Pathway C - Building Products Processed at >1000°C
- ZDHC Disposal Pathway D - Landfill with Limited Control Measures
- ZDHC Disposal Pathway E - Offsite Incineration and Building Products Processed at <1000°C
- ZDHC Disposal Pathway F - Landfills with No Control Measures
- ZDHC Disposal Pathway G - Land Application

Table 4A shows the testing parameters and the limits for each ZDHC Disposal Pathway. Laboratories will first test all sludge samples for conventional sludge parameters, certain organic ZDHC MRSL compounds, and total metals. If the total metals threshold values are exceeded, the laboratory will conduct leachate testing of the sludge for the metals that exceed the total metals threshold. Table 4B contains the consolidated ZDHC Disposal Pathway limits for conventional sludge parameters, organic ZDHC MRSL compounds, and leachate metals.

These guidelines recommend methods for analysis and testing based on internationally recognised standard water and wastewater testing methodologies, as well as government-recognised testing requirements in the European Union, the United States of America, China, and India. Equivalent methods can be used, and must be approved by ZDHC.

Table 4A: Sludge Parameters

STEP 1: All must test the following parameters.						
Parameters	**Reporting Limit (mg/kg-Dry Weight)**	**Standard Method for Sludge Analysis/Testing Total Metals** Equivalent methods can be used if approved by ZDHC				
		Description of Lab Method	International/ Europe	USA	China	India
Metals						
Antimony	Textile only: 5	**Preparation:** Acid/peroxide digestion **Analysis:** ICP/OES, or ICP/MS		**Preparation:** EPA 3050 **Analysis:** EPA 6010D, or EPA 6020B	HJ 803	
Arsenic	Textile: 5 Leather: 2					
Barium	Textile only: 200					
Cadmium	Textile: 1 Leather: 2				HJ 803	
Cobalt	Textile only: 400					
Copper	Textile only: 50					
Lead	Textile: 5 Leather: 2					
Nickel	Textile only: 20					

Table 4A: Sludge Parameters (continued)

STEP 1: All must test the following parameters.

STEP 1: All must test the following parameters.						
Parameters	**Reporting Limit (mg/kg-Dry Weight)**	**Standard Method for Sludge Analysis/Testing Total Metals** Equivalent methods can be used if approved by ZDHC				
		Description of Lab Method	International/ Europe	USA	China	India
Metals (continued)						
Selenium	Textile only: 5	**Preparation:** Acid/peroxide digestion **Analysis:** ICP/OES, or ICP/MS		**Preparation:** EPA 3050 **Analysis:** EPA 6010D, or EPA 6020B	HJ 803	
Silver	Textile only: 50					
Total Chromium	Textile only: 50					
Zinc	Textile only: 400					
Chromium (VI)	Textile: 20 Leather: 2	**Preparation:** Alkaline digestion **Analysis:** Colourimetric UV/VIS, or Colourimetric IC		**Preparation:** USEPA 3060a **Analysis:** USEPA 7196 or USEPA 7199	HJ 1802	
Mercury	Textile: 1 Leather: 0.2	**Preparation Option 1:** Dissolution, acid digestion **Preparation Option 2:** Dissolution, acid/per-oxide digestion **Analysis:** CVAA or ICP MS		**Preparation Option 1:** EPA 7471 b **Preparation Option 2:** EPA 3051a **Analysis Option 1:** EPA 7471b **Analysis Option 2:** 6020b	GB/T 22105.1 HJ 923	
Anions						
Cyanide	Textile only: 20	**Preparation:** CN converted to HCN by reflux-distillation to NaOH **Analysis:** Colourimetry (EPA 9014), or ISE (EPA 9213)		**Preparation:** USEPA 9013 **Analysis:** HJ745, EPA 9014 or EPA 9213	HJ 745	

Table 4A: Sludge Parameters (continued)

STEP 1: All must test the following parameters.

STEP 1: All must test the following parameters.						
Parameters	**Reporting Limit (mg/kg-Dry Weight)**	**Standard Method for Sludge Analysis/Testing Total Metals** Equivalent methods can be used if approved by ZDHC				
		Description of Lab Method	International/ Europe	USA	China	India
Conventional						
pH		**Preparation:** Suspension with Water **Analysis:** ISE		**Preparation and Analysis:** EPA SW 9045D or HJ962	HJ 962	
% Solids		**Analysis:** Dry at 105°C		**Analysis:** EPA 160.3, HJ613 at 105°C	HJ 613 drying at 105°C	
Paint Filter Test				**Analysis:** EPA SW-846 or EPA 9095B		
Fecal Coliform		**Preperation:** Blended suspension **Analysis:** Multiple Tube Fermintation		**Analysis:** EPA 1681		
MRSL						
Alkylphenol (AP) and Alkylphenol Ethoxylates (APEOs): including all isomers	Textile and Leather: 0.4	**Preparation:** Modified dichloromethane extraction with mechanical agitation, soxhlet, or ultrasonic **Analysis:** NP/OP, GC-MS, LC-MS **Analysis:**: OPEO/NPEO (n>2): GC-MS; LC-MS **Analysis:** OPEO/NPEO (n=1,2), GC-MS, LC-MS	**Analysis:** NP/OP ISO 18857-2; ASTM D7065 OPEO/NPEO n>2 ISO 18254-1 OPEO/NPEO n=1,2 ISO 18857-2; ASTM D7065	**Preparation:** USEPA 3540/3541 soxhlet USEPA 3550 ultrasonic		
Polycyclic Aromatic Hydrocarbons (PAHs)	Textile only: 0.2	**Preparation:** Dichloromethane extraction with mechanical agitation, soxhlet, or unltrasonic **Clean up:** GPC **Analysis:** GC-MS		**Preparation:** USEPA 3540/3541 soxhlet USEPA 3550 ultrasonic **Clean up:** USEPA 3650 **Analysis**: USEPA 827	HJ 805-2016	
Chlorotoluenes (only)	Textile and Leather: 0.2				HJ 605	

Table 4B: Sludge Parameters (continued)

STEP 2: Evaluate if the Total Metals sampled and tested in Step 1, exceed the Total Metals Threshold Values (mg/kg) given in this column. If so proceed with Leachate testing.

STEP 3: If Total Metals Threshold Values (mg/kg) given in this column are not exceeded, any disposal pathway for your sludge tested is acceptable.

STEP 2: Leachate limits must be met if Total Metals and Anions Threshold Values (mg/kg) are exceeded.

		Disposal Pathways							Standard Methods for TCLP Analysis / Testing Equivalent methods can be used if approved by ZDHC				
Parameters	**Total Metals and Anions Threshold Values (mg/kg)[a]**	**A Offsite Incineration at >1000°C** **B Landfill with Significant Control Measures**	**C Building Products Processed at >1000°C**	**D Landfill with Limited Control Measures**	**E Offsite Incineration and Building Products Processed at <1000°C**	**F Landfill with No Control Measures**	**G Land Application**						
		Leachate result (TCLP) in mg/L						Max Total Metals limit (mg/kg)	Description of Lab Method	International/ Europe	USA	China	India
Arsenic	10	Report Only if Required to Test	5	2.75	0.5	0.5	0.5	75	**Leachate Extraction:** Toxicity Leachate Extraction Procedure followed by Acid Digestion **Analysis:** ICP/ OES, or ICP/ MS	**Leachate Extraction:** EPA 1311 **Analysis:** ISO 11885 ISO 17294-2	**Leachate Extraction:** EPA 1311 followed by Acid Digestion EPA 3051A **Analysis:** USEPA 200.7 USEPA 200.8 USEPA 6010c USEPA 6020a		
Cadmium	3		1	0.58	0.15	0.15	0.15	85					
Total Chromium	100		15	10	5	5	5	3000					
Lead	10		5	2.75	0.5	0.5	0.5	840					
Antimony	12		15	7.8	0.6	0.6	0.6	Sample and Report Only					
Barium	700		100	67.5	35	35	35						
Cobalt	1600		80	80	80	80	80						

[a] Digested and analysed for total metals.

Table 4B: Sludge Parameters (continued)

STEP 2: Evaluate if the Total Metals sampled and tested in Step 1, exceed the Total Metals Threshold Values (mg/kg) given in this column. If so proceed with Leachate testing.

STEP 3: If Total Metals Threshold Values (mg/kg) given in this column are not exceeded, any disposal pathway for your sludge tested is acceptable.

STEP 2: Leachate limits must be met if Total Metal and Anions Threshold Values (mg/kg) are exceeded.

		Disposal Pathways										
Parameters	**Total Metals and Anions Threshold Values (mg/kg)[a]**	**A Offsite Incineration at >1000°C** **B Landfill with Significant Control Measures**	**C Building Products Processed at >1000°C**	**D Landfill with Limited Control Measures**	**E Offsite Incineration and Building Products Processed at <1000°C**	**F Landfill with No Control Measures**	**G Land Application**	**Standard Methods for TCLP Analysis / Testing** Equivalent methods can be used if approved by ZDHC				
		Leachate result (TCLP) in mg/L					Max Total Metals limit (mg/kg)	Description of Lab Method	International/ Europe	USA	China	India
Copper	200	Report Only if Required to Test	25	17.5	10	10	10	4300	**Leachate Extraction:** Toxicity Leachate Extraction Procedure followed by Acid Digestion **Analysis:** ICP/ OES, or ICP/ MS	**Leachate Extraction:** EPA 1311 **Analysis:** ISO 11885 ISO 17294-2	**Leachate Extraction:** EPA 1311 followed by Acid Digestion EPA 3051A **Analysis:** USEPA 200.7 USEPA 200.8 USEPA 6010c USEPA 6020a		
Nickel	70		20	11.75	3.5	3.5	3.5	420					
Selenium	10		1	0.75	0.5	0.5	0.5	100					
Silver	100		5	5	5	5	5	Sample and Report Only					
Zinc	1000		250	150	50	50	50	7500					
Cyanide	70		5	4.25	3.5	3.5	3.5	590					
Chromium (VI)	50		5	3.75	2.5	2.5	2.5	50	**Preparation:** Toxicity Leachate Extraction Procedure **Analysis:** Colourimetric UV/VIS, or Colourimetric IC	**Leachate Extraction:** EPA 1311 **Analysis:** ISO 18412	**Preparation:** USEPA 1311 **Analysis:** USEPA 7196 or USEPA 7199		

[a] Digested and analysed for total metals.

Table 4B: Sludge Parameters (continued)

STEP 2: Evaluate if the Total Metals sampled and tested in Step 1, exceed the Total Metals Threshold Values (mg/kg) given in this column. If so proceed with Leachate testing.

STEP 3: If Total Metals Threshold Values (mg/kg) given in this column are not exceeded, any disposal pathway for your sludge tested is acceptable.

STEP 2: Leachate limits must be met if Total Metal and Anions Threshold Values (mg/kg) are exceeded.													
		Disposal Pathways							**Standard Methods for TCLP Analysis / Testing** Equivalent methods can be used if approved by ZDHC				
Parameters	**Total Metals and Anions Threshold Values (mg/kg)[a]**	**A Offsite Incineration at >1000°C** **B Landfill with Significant Control Measures**	**C Building Products Processed at >1000°C**	**D Landfill with Limited Control Measures**	**E Offsite Incineration and Building Products Processed at <1000°C**	**F Landfill with No Control Measures**	**G Land Application**						
		Leachate result (TCLP) in mg/L						Max Total Metals limit (mg/kg)	Description of Lab Method	International/ Europe	USA	China	India
Mercury	1	Report Only if Required to Test	0.2	0.125	0.05	0.05	0.05	57	**Preparation:** Toxicity Leachate Extraction Procedure followed by Dissolution, acid digestion **Analysis:** CVAA or ICP MS	**Analysis:** ISO 12846 or ISO 17852	**Preparation:** USEPA 1311 followed by EPA 7471b, or EPA 3051a **Analysis:** EPA 7471b, or EPA 6020b		
Anions													
Cynaide	70	Report Only if Required to Test	5	4.25	3.5	3.5	3.5	590	**Preparation:** Toxicity Leachate Extraction Procedure followed by CN converted to HCN by reflux-distillation to NaOH **Analysis:** Colourimetry (EPA 9014), or ISE (EPA 9213)		**Preparation:** USEPA 1311 followed by USEPA 9013 **Analysis:** EPA 9014 or EPA 9213	**Analysis:** HJ 745	

[a] Digested and analysed for total metals.

Table 4C: Sludge Parameters (continued)

Corresponding Conventional and Organic ZDHC MRSL limits for specific Disposal Pathways for Textile and Leather.						
Parameters	**A Offsite Incineration at >1000°C** **B Landfill with Significant Control Measures**	**C Building Products Processed at >1000°C**	**D Landfill with Limited Control Measures**	**E Offsite Incineration and Building Products Processed at <1000°C**	**F Landfill with No Control Measures**	**G Land Application**
	Test Results					
pH	Sample and Report Only	5 - 11 s.u	5 - 11 s.u	5 - 11 s.u	6.5 - 9 s.u.	6.5 - 9 s.u.
% Solids		Sample and Report Only	Sample and Report Only	Sample and Report Only	Sample and Report Only	Sample and Report Only
Fecal Coliform					<1,000 (MPN/g)	
Paint Filter Test			Pass Paint Filter Test	Pass Paint Filter Test		Sample and Report Only
Alkylphenol (AP) and Alkylphenol Ethoxylates (APEOs): including all isomers		Sample and Report Only	< 0.4 mg/kg			
Polycyclic Aromatic Hydrocarbons (PAHs)			< 0.2 mg/kg			
Chlorotoluenes (only)						

Sludge Documentation

To better protect human health and the environment, supplier profiles must be up to date at all times in the ZDHC Gateway. All documents and records related to the quantity, quality, and disposal of all sludge generated must be up to date, clearly maintained, and readily available at all times for samplers and auditors before auditing or sampling sludge.

Documentation is required for each ZDHC Disposal Pathway as described in the ZDHC Sludge Reference Document. All sludge documentation should be made available for review[2].

[2] Reviews are part of, for example, the Supplier to Zero Programme or can be conducted by brands using ZDHC Gateway data.

ZDHC Wastewater Candidate List, Table 5

The candidate list is a signal of intended changes to future updates of the WW Guidelines. These can include:

- Future addition of new conventional, ZDHC MRSL or other parameters;
- Future changes in limits for existing parameters;
- Future inclusion of a new testing technique;
- Advance notice of extended scope to deal with pressing industry challenges – such as microfibres;
- Advance notice of change of ZDHC approach to promote best practice – such as linking water consumption per unit of production with WW Guideline limits.

The aim of the Candidate List is to give advance notice to the industry of what to expect in future updates, and therefore gives the industry enough time to prepare for these, thus facilitating wide-scale industry adoption and implementation. The candidate list is a live list and can be updated and revised on an on-going basis – including any changes to the ZDHC MRSL V2.0 Candidate List.

There is no mandatory requirement to conduct testing, RCA and CAP for candidate list entries, but it is strongly advised that a proactive approach is adopted.

Parameter	Intention for Restrictions
ZDHC MRSL V2.0 candidate list	The following chemicals, that are on the ZDHC MRSL V2.0 candidate list, are likely to be added to the main ZDHC MRSL list in future updates and are therefore likely to be added to the Wastewater Guidelines in future updates. It is advisable to check chemical inputs and wastewater for their presence and avoid their use where possible. Aniline C.I. Basic Green 4 Leuco Base Trixylyl phosphate Tri-o-cresyl phosphate Trimethyl phosphate All PFCs / PFAS Other chemicals on the ZDHC MRSL V2.0 candidate list are also likely to be added to the main ZDHC MRSL list in future updates but, at the time of publication of this document, it is less certain that they will require mandatory testing in wastewater.
Microfibres	Natural and synthetic textile fibres can fragment during wet processing and finishing and then enter the aquatic environment. Once size distribution studies are completed, and a reliable test method is developed, it is intended to introduce a requirement for microfibres/fibre fragment discharge to be measured and reported before introducing a limit.
Water Consumption	Over-abstraction and over-use of water should be avoided to preserve freshwater supplies. Additionally, reducing water consumption tends to result in a reduction of energy and chemical consumption. WW Guideline limits must be met by controlling chemical inputs and appropriate remediation without dilution. In the future, ZDHC may require reports of total water usage before introducing sector-specific water use targets.
Effluent Toxicity	The WW Guidelines consider many different chemicals and conventional parameters, but the list is not exhaustive. To reduce the risk of chemicals that are not listed causing problems, ZDHC may introduce a check for effluent toxicity to provide extra reassurance.
Smart, Intelligent Testing	WW Guidelines requires that all ZDHC MRSL, Conventional (inc. anions), and metals are tested twice per year. In the future, ZDHC intends to use reliable test data and past facility performance information to create a framework where an intelligent testing programme targets risks and eliminates test redundancy. This may include an intelligent testing programme based on factors including ZDHC MRSL conformance of chemical inputs (InCheck), performance test history (ClearStream) and product and process-specific risks to improve efficiency and ease of roll-out of the ZDHC Roadmap to Zero Programme.

What is Out of Scope of the Wastewater Guidelines?

These WW Guidelines do not currently apply to wastewater discharge from suppliers such as, but not limited to:

- Non-textile trims, e.g. buttons, zippers (plastic, metal, glass, shells etc.), and galvanising processes;
- Cotton farming, cattle ranching, polymer production, raw wool scouring;
- Production of chemicals or mixing of chemical formulations for commercial sale.

In addition, these WW Guidelines do not currently apply to:

- Discharges of domestic wastewater only, for instance, from a sewing/garmenting (e.g. staking) facility that employs workers but has no in-house wet processing unit or domestic wastewater not blended with industrial wastewater.
- Wastewater management and treatment systems beyond the property boundaries of the supplier. This includes any third-party, off-site, centralised or common effluent treatment plants (CETP) that are not under direct control and/or ownership of the supplier.
  - » CETPs can choose to monitor their performance against these guidelines.
  - » Any supplier who discharges to CETP is deemed an indirect supplier and should test against these guidelines.
- For a comprehensive list of the different types of sludges, and those that are Out of Scope for the applicability of the WW Guidelines refer to Sludge Reference Document.

What is In Scope of the Wastewater Guidelines?

Wet-processing Suppliers

These WW Guidelines apply to industrial[3] wastewater discharged and sludge[4] produced from wastewater treatment operations of textile, leather, home, apparel and footwear suppliers with wet processing facilities including, but not limited to:

- Dyeing and finishing of: fibres, yarns, threads, fabrics, garments, trims and laces.
- Fabric mills.
- Laundry, washing and finishing facilities.
- Printing facilities.
- Vertical finished goods manufacturing facilities where any of the above wet processes occur.
- Synthetic materials (synthetic fibres or textile-polymer composite microfibres), coated with PU, PVC or similar that holds the appearance of leather but is not made from animal skin or hide (mock leather).

Separate wastewater guidelines are available for Man-Made Cellulosic Fibres (MMCF) suppliers.

[3] Where a supplier combines their industrial wastewater with their domestic wastewater, the resulting combined wastewater is classified as industrial wastewater, to which these WW Guidelines would apply.

[4] For a comprehensive list of different types of sludges and those that are In Scope for the applicability of the WW Guidelines - refer to the ZDHC Sludge Reference Document.

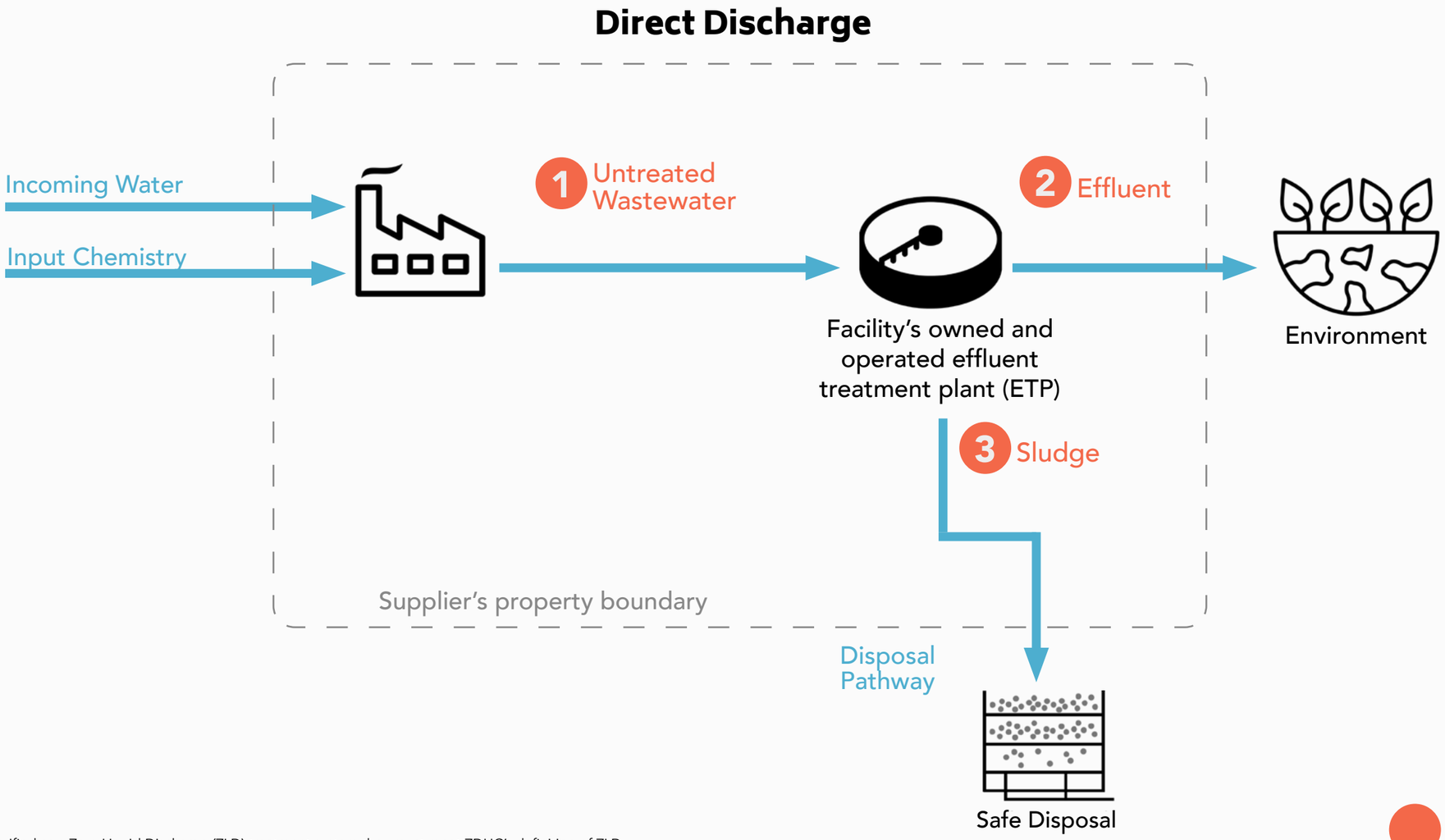
Wastewater Discharge Types and Sample Locations

There are four ZDHC Supplier Types under wastewater: Direct, Indirect with pretreatment, Indirect without pretreatment and Zero-Liquid Discharge (ZLD)[5], which are illustrated below in Figure 2a to 2d. Suppliers must identify with one of the four supplier types and specify this by completing the ZDHC Gateway Supplier Profile.

Additionally, there are three possible sampling locations, also illustrated in Figure 2.

- **Untreated Wastewater** - (previously referred to as 'Raw wastewater'), Wastewater that is collected prior to any treatment.
- **Effluent** - treated or partially treated wastewater that leaves the facility boundary.
- **Sludge** - the residual solid, semisolid, or slurry material generated as a by-product of wastewater treatment processes, including primary, secondary and tertiary (ZLD) treatments.

Figure 2a: Schematic illustration of the Sample Locations for a Direct Discharge Supplier. **Sampling locations:** *Untreated Wastewater, Effluent, Sludge.*



Sample Locations shown in red

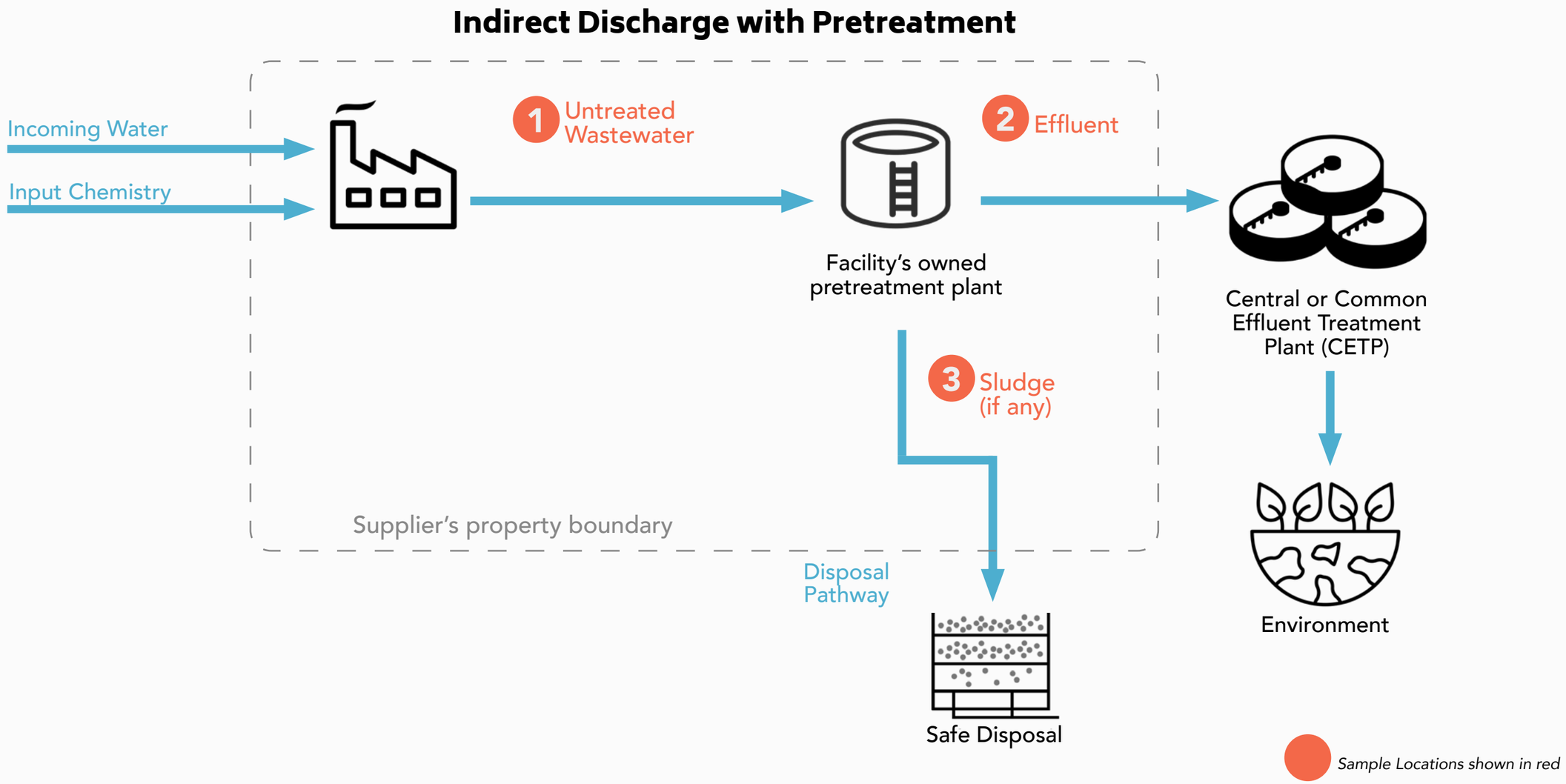
[5] For suppliers to be classified as a Zero Liquid Discharge (ZLD) treatment system they must meet ZDHC's definition of ZLD.

Wastewater Discharge Types and Sample Locations (continued)

Indirect Discharge: The discharge of wastewater through an industrial wastewater sewer system to a central or common effluent treatment plant (CETP), not owned and/or operated by the supplier discharging the wastewater. CETP is also referred to as off-site wastewater treatment, and there are two main models of Indirect discharge:

- **With pretreatment** where wastewater is collected, mixed and then treated using physical, chemical or biological processes prior to discharge to CETP.

Figure 2b: Schematic illustration of the Sample Locations for an Indirect Discharge with pretreatment Supplier. **Sampling locations:** *Untreated Wastewater, Effluent, Sludge.*

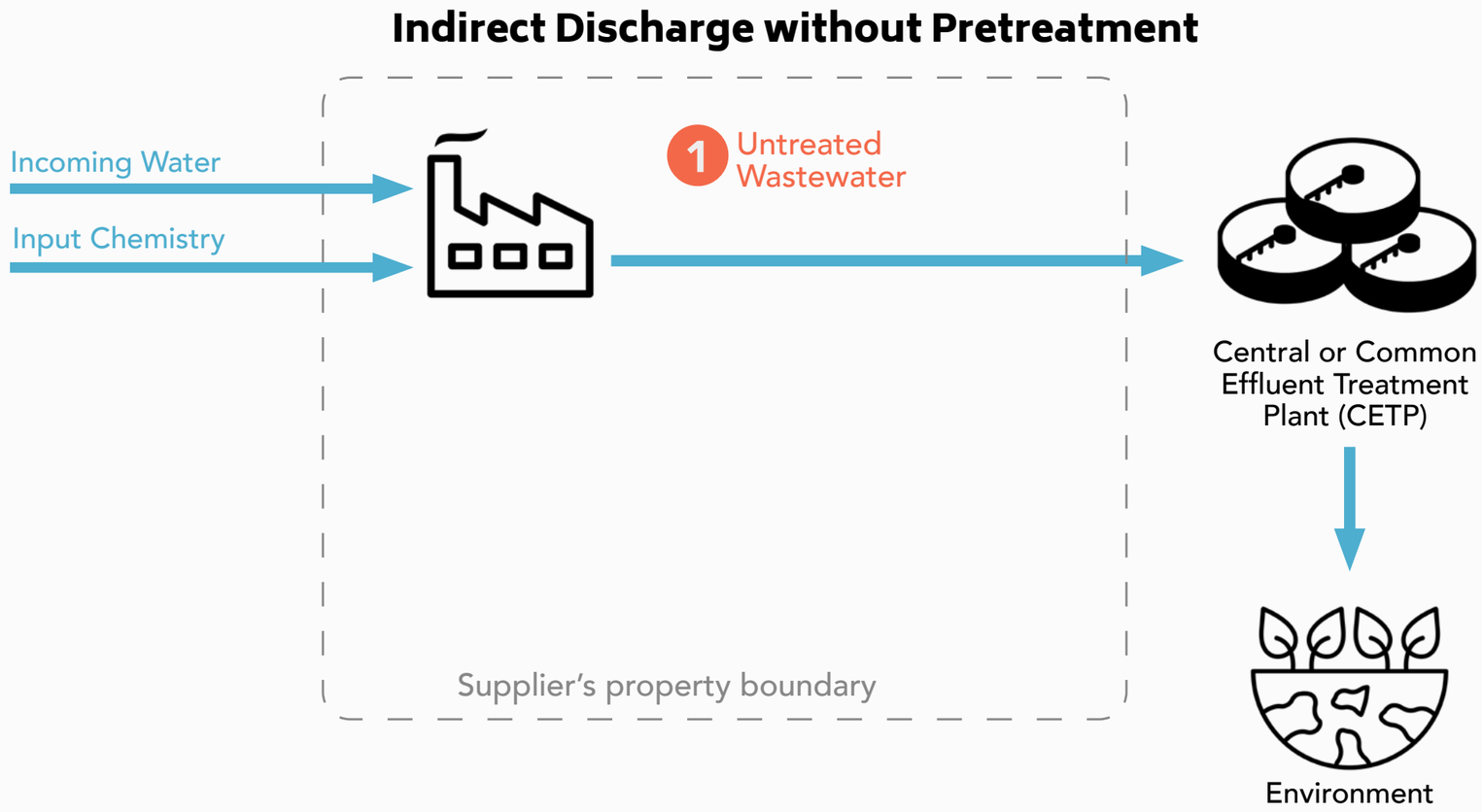


Wastewater Discharge Types and Sample Locations (continued)

Indirect Discharge: The discharge of wastewater through an industrial wastewater sewer system to a central or common effluent treatment plant (CETP), not owned and/or operated by the supplier discharging the wastewater. CETP is also referred to as off-site wastewater treatment, and there are two main models of Indirect discharge:

- **Without pretreatment** where the wastewater goes directly from processing to the CETP.

Figure 2c: Schematic illustration of the Sample Locations for an Indirect Discharge without pretreatment Supplier. **Sampling locations:** *Untreated Wastewater.*

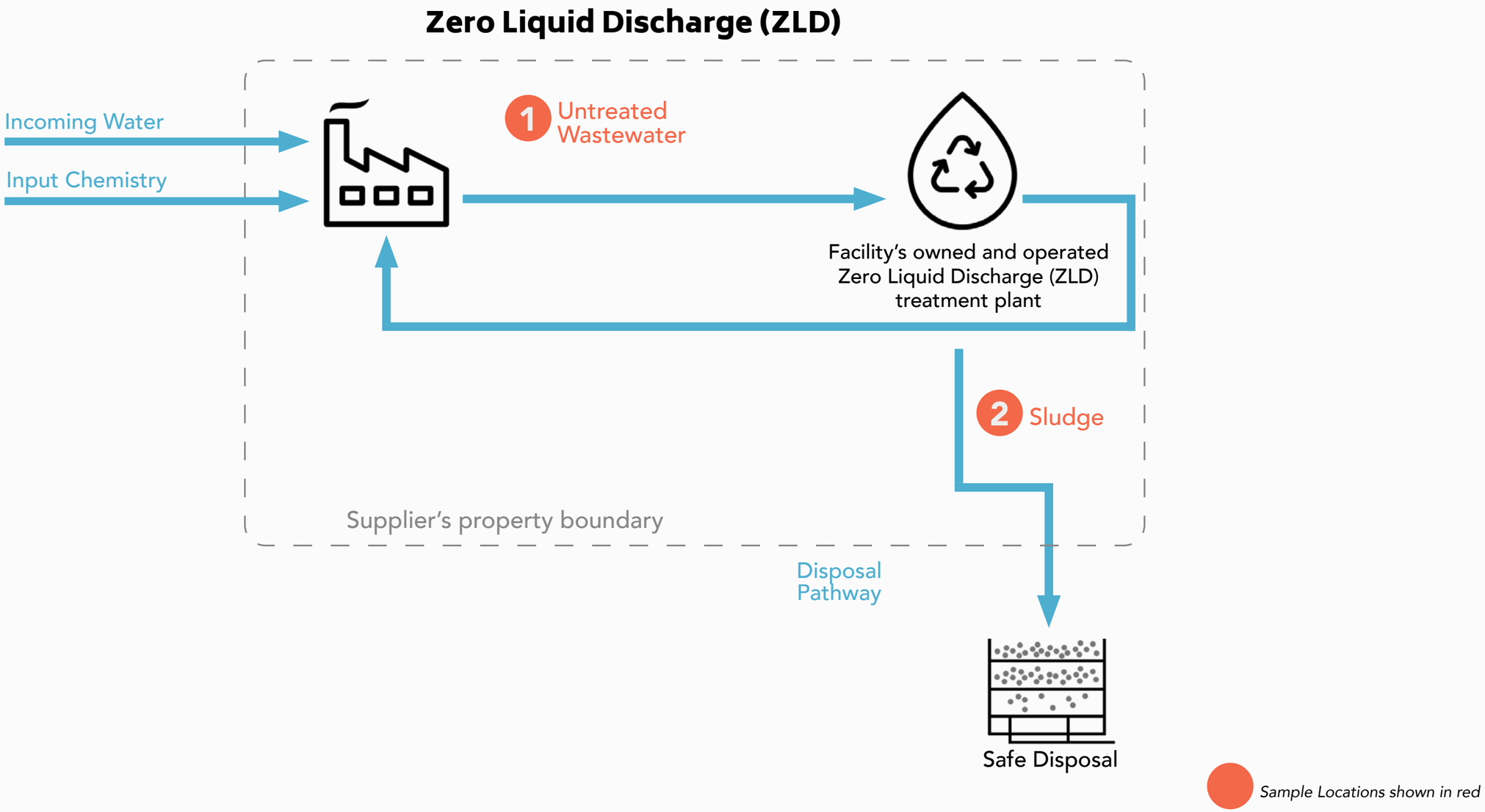


Sample Locations shown in red

Wastewater Discharge Types and Sample Locations (continued)

Zero Liquid Discharge (ZLD): The concept that no industrial wastewater or effluent leaves a supplier's site in liquid form. On-site ZLD treatment system treats and recovers almost all wastewater such that the only water lost is through evaporation or as moisture in the sludge from treatment plant operations. A supplier is not considered to have a ZLD treatment system if there is any industrial liquid discharge.

Figure 2d: Schematic illustration of the Wastewater Discharge Types and Sample Locations. **Sampling locations:** *Untreated Wastewater, Sludge.*



What and Where to Sample and Test as Part of ZDHC Wastewater Guidelines?

Table 7 and 8 set out the parameters to test, depending on suppliers' effluent discharge types (e.g. Direct, Indirect or ZLD) and the average daily wastewater generated.

ZDHC appreciates that wet processing facilities use different amounts of water. For example, screen printing facilities that wash moulds, screens, and tools will have a lower volumetric water use due to irregular and intermittent flow of water when compared to a typical dye house.

As a result, there are different testing requirements for suppliers with an average total industrial wastewater generated, that is equal to, or greater than, 15m^3 per day, different to suppliers that discharge lower than 15m^3 per day irrespective of the supplier's production type or production processes[6]. 15m^3 of industrial wastewater is calculated based on (wastewater generated / total number of working days per year).

Table 7

Suppliers that generate on average, equal to, or more than 15m^3 of industrial wastewater per day				
Test parameters and sample locations/ discharge types	**ZDHC MRSL[7]** Sample untreated wastewater and test Tables 1A-1T parameters	**ZDHC Heavy Metals** Sample effluent and test Table 2 parameters	**ZDHC Conventional and Anions** Sample effluent and test Table 3 parameters	**ZDHC Sludge** Sample sludge and test Table 4 parameters
Direct	Sample and test	Sample treated effluent and test	Sample and test	Sample and test against the chosen ZDHC sludge disposal pathway in accordance with the ZDHC Sludge Guideline
Indirect with pretreatment	Sample and test	Sample pre-treated effluent and only test[8] the following: Arsenic, Cadmium, Chromium (VI), Lead, Mercury	No sample or testing required	Sample and test against the chosen ZDHC sludge disposal pathway in accordance with the ZDHC Sludge Guideline
Indirect without pretreatment	Sample and test[9]	Sample and only test[10] the following: Arsenic, Cadmium, Chromium (VI), Lead, Mercury	No sample or testing required	Not applicable, no sample or testing required
ZLD	Sample and test	No sample or testing required	No sample or testing required	Sample and test against the chosen ZDHC sludge disposal pathway in accordance with the ZDHC Sludge Guideline

[6] From any wet processing and/or from any operation such as rinsing screens, tools or equipment wash. This includes but is not limited to sizing, desizing, pretreatment, dyeing, printing (including digital printing), finishing, laundry, non-woven manufacturing using hydro entanglement, etc.

[7] Excluding Heavy Metals.

[8] RCA/ CAP in the event of a detection.

[9] Composite sample is must.

[10] Composite sample is must. RCA/ CAP in the event of a detection.

What and Where to Sample and Test as Part of ZDHC Wastewater Guidelines? (continued)

Table 8

Suppliers that generate on average, less than 15m³ of industrial wastewater per day				
Test parameters and sample locations/ discharge types	**ZDHC MRSL[11]** Sample untreated wastewater and test Tables 1A-1T parameters	**ZDHC Heavy Metals** Sample effluent and test Table 2 parameters	**ZDHC Conventional and Anions** Sample effluent and test Table 3 parameters	**ZDHC Sludge** Sample sludge and test Table 4 parameters
Direct	No sample or testing required	Sample and test	Sample and test	No sample or testing required
Indirect with pretreatment	No sample or testing required	No sample or testing required	No sample or testing required	No sample or testing required
Indirect without pretreatment	No sample or testing required	No sample or testing required	No sample or testing required	No sample or testing required
ZLD	No sample or testing required	No sample or testing required	No sample or testing required	No sample or testing required

[11] Excluding Heavy Metals.

ZDHC Wastewater Guidelines
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How is Performance Against the ZDHC Wastewater Guidelines Measured?

The ZDHC ClearStream report determines suppliers' performance against the ZDHC Wastewater Guidelines. The ZDHC ClearStream process ensures that only ZDHC approved laboratories conduct the sampling and testing, and upload the results directly to the ZDHC Gateway, where the suppliers can share them with their brand partners.

The expectation is that suppliers sample and test according to Sample Matrix given in Table 7 and 8, and that they meet:

1. All reporting limits for ZDHC MRSL Wastewater Parameters, Table 1A-1T, and
2. At least wastewater foundational limits for all Heavy Metals, Table 2, and
3. At least wastewater foundational limits for all Conventional and Anions, Table 3, and
4. Meet the ZDHC recommended Disposal Pathway(s) for Sludge testing, Table 4A-C.

We encourage the value chain to consider overall facility performance a holistic approach. This should combine the results from the ZDHC ClearStream report with the ZDHC InCheck and Supplier Platform modules, for example, the Effluent Treatment Module or the Supplier to Zero Programme.

Minimum Frequency for Sampling, Testing and Reporting

Sampling, testing and reporting on ZDHC WW Guidelines to be completed at least twice per year, at the latest by April 30 and October 31. Sampling, testing, and reporting can occur anytime during each reporting cycle, as long as there are at least three months between sample dates for the two reporting deadlines.

Suggested reporting deadlines per year:

01 November - 30 April **and** **01 May - 30 October**

Where to Find a ZDHC Accepted Laboratory?

To support the implementation of the WW Guidelines in the value chain and to ensure a consistent level of data quality, ZDHC has established the ZDHC Laboratory and Certifier Acceptance Programme. Only ZDHC Accepted Laboratories that have been approved to test against the ZDHC Wastewater Guidelines, can perform sampling, testing, and report results into the ZDHC Gateway. These laboratories must strictly follow the WW Guidelines and the ZDHC Wastewater and Sludge Laboratory Sampling and Analysis Plan (SAP), which provides a detailed framework for laboratories to determine the concentration of parameters in wastewater and sludge.

To support the implementation of the ZDHC Wastewater Guidelines in the supply chain and to ensure a consistent level of quality for wastewater and sludge test data submitted in the ZDHC Gateway – Wastewater Module platform, ZDHC has established the ZDHC Gateway Laboratory Acceptance Programme – Wastewater Guidelines.

- ZDHC acceptance means a laboratory has the qualified personnel, equipment and processes in place to analyse wastewater and sludge samples. It does not however give any assurance that data is acceptable for any given sample. That can only be assured by examination of the associated quality control samples.
- Information on the minimum acceptance criteria, subcontracting principles, application and review process, etc. is described in the laboratory online application form on the ZDHC website (accessible to all).
- The latest list of ZDHC Accepted Laboratories is available on the ZDHC website.
- Only ZDHC Accepted Laboratories can submit test data on behalf of suppliers to the ZDHC Gateway – Wastewater Module platform.
- ZDHC expects all of its accepted laboratories to conduct sampling and testing/ analysis following the procedures specified in the ZDHC Wastewater and Sludge Laboratory Sampling and Analysis Plan (SAP) document publicly available on the ZDHC website.

Acknowledgements

We warmly thank the ZDHC contributors who provided their expertise, practical input, critical feedback, and constructive suggestions in the creation of these WW Guidelines. In particular the members of the Textiles and Sludge Task Teams, Wastewater Council and the Laboratory Advisory Groups.

Appendix A
Expanded Revision History

In the spirit of continuous improvement, the WW Guidelines will be reviewed and revised as needed. The WW Guidelines have been edited to incorporate learnings and opportunities identified during the practical application and implementation over the past years. A historical record of the updates is given below.

Figure 3: Extended revision history of the ZDHC Wastewater Guidelines

Version Number	Changes	Time of Publication
Version 1.1	No changes made to the parameters and limit values for wastewater (Appendix A Tables 1A-1B and Tables 2A-2N), however, the conventional parameters in Appendix A Table 1 were reformatted into two sub-tables: Table 1A covers sum parameters and anions, and Table 1B covers metals. • No changes made to the parameters for sludge. However, the reporting limits, standard methods for sludge analysis, and lab description methods have been specified in Appendix A Table 3. • Integrated the requirements from the ZDHC Interim Guidelines for suppliers with an on-site Zero Liquid Discharge (ZLD) treatment system - released in February 2019. In addition, the scope of metals testing for raw wastewater is expanded. Please refer to section 9.5.0 • Removed sampling and testing of incoming water1 from the Guidelines requirements. Instead, this could be part of the Root Cause Analysis when there is non-conformance to test results of the ZDHC MRSL parameters. • Expanded the standard methods for analysis for conventional parameters to allow suppliers to use legal compliance testing data/results for ZDHC reporting requirements, following certain conditions and exceptions as specified in section 9.6.0 • Added testing guidelines for Persistent Foam in section 9.6.0 • Restructured the content to improve the logic and flow of information. • Re-numbered paragraphs and sections to facilitate easy reference to parts of the document. • Re-formatted the text of the document to clarify requirements on sampling, testing, and reporting.	July 2019
Version 1.0	In 2015, ZDHC commissioned a study to better understand the regulatory landscape of wastewater discharge regulations and guidelines across the textile industry. This study concluded: • Wastewater discharge quality regulations vary greatly from country to country and region to region. • Current wastewater regulations do not necessarily focus on the management of hazardous chemicals. • Wastewater guidelines published by different brands, as well as amongst multi-brand consortia, vary greatly, resulting in duplication of testing for suppliers. • There is a need for uniform, global guidance pertaining to wastewater discharge quality, as well as testing and reporting, to enable a more sustainable industry. Following this study, was the Initial publication of the ZDHC Wastewater Guidelines.	November 2016